15. (Unamended) An electromagnetic wave detector according to claim 13, wherein a high voltage is applied to the common electrode of said conversion elements and a shielding conductor is arranged near the common electrode.

16. (Unamended) An electromagnetic wave detector according to claim 9, wherein thin film read transistors and said thin film reset transistors are formed on an insulating substrate provided with a driver circuit for driving the thin film read transistors and the thin film reset transistors and with a read circuit for reading signals from said thin film read transistors.

REMARKS

Applicant requests reconsideration and allowance of the present application in view of the foregoing amendments and the following remarks.

Claims 1-16 are pending in the present application. Claims 1 and 9 are the independent claims.

Claims 1, 4, 5, 9, 12, and 13 have been amended. No new matter is believed to have been added. Applicant submits that the amendments to Claims 1, 4, 5, 9, 12, and 13 relate only to matters of form and do not narrow the scope of the claims.

The Office Action objected to Figures 14A, 14B, and 15 for failing to include a legend such as "Prior Art." The Office Action also objected to the drawings under 37 C.F.R. §1.84(p)(5) for including reference numerals not mentioned in the description. In addition, the Office Action objected to Figure 2 based on the inclusion of the reference to "Vc."

By separate paper filed concurrently herewith, Applicant seeks approval to amend Figures 14A, 14B, and 15 to include the legend --PRIOR ART--. Applicant also seeks approval to amend Figures 13, 14A and 15 to delete reference numeral 1008 from Figure 13, reference numerals 102a-102c and 112 from Figure 14A, and reference numeral 231 from Figure 15. Further, regarding Figure 2, Applicant seeks approval to amend that figure to delete "Vc" and "Vs." In addition, by the present Amendment, Applicant has amended the specification to mention reference numerals 136 of Figure 14A and reference numeral 160 of Figure 15. Favorable reconsideration and withdrawal of the objections to the drawings are respectfully requested.

Applicant notes that the Office Action references a substitute specification filed February 6, 2002. However, Applicant has no record of such a filing in the present application. Accordingly, Applicant requests clarification on this point.

The Office Action objected to the Abstract on formal grounds. The Office Action also objected to the mention of reference numeral 8 on line 11 of page 20 of the disclosure on formal grounds. By the present Amendment, Applicant has amended the Abstract in view of the Examiner's comments and amended the specification as kindly suggested by the Examiner. Favorable reconsideration and withdrawal of the objections to the written disclosure are requested.

Claims 1-16 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. Specifically, the Office Action takes issue with the term "OFF voltage" for thin film reset resistors. In response, Applicant wishes to explain that the term "OFF voltage" is used in combination with the term "ON" voltage to represent one of the two values between which the gate potential swings in the operation of an FET. The reset

transistors are operated, in a like manner as the read transistors, such that their gate potential swings between an OFF voltage and an ON voltage. With respect to this point, the only difference from the operation of the read transistors is that the OFF voltage is closer to the ON voltage (i.e. higher in case of n-channel FETs) than in the case of the read transistors. Consequently, Applicant believes that the use of the term "OFF voltage" is not repugnant to the ordinary meaning of the term. Reconsideration and withdrawal of the §112, second paragraph, rejection are requested.

Claims 1-3, 5, 8-11, 13, and 16 stand rejected under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,869,837 (Huang) in view of U.S. Patent No. 5,852,296 (Tsukamoto, et al.). Claims 4, 6, 12, and 14 stand rejected under 35 U.S.C. §103(a) as being obvious over Huang in view of Tsukamoto, et al. and further in view of U.S. Patent No. 5,391,881 (Jeuch, et al.). Claims 7 and 15 stand rejected under 35 U.S.C. §103(a) as being obvious over Huang in view of Tsukamoto, et al. and further in view of U.S. Patent No. 6,075,248 (Jeromin, et al.). These rejections are respectfully traversed.

Independent Claim 1 recites, inter alia, thin film read transistors connected respectively to corresponding storage capacitors and each having a gate to which ON and OFF voltages are applied respectively in readout and storage periods, thin film reset transistors connected respectively to corresponding storage capacitors and each having a gate to which ON and OFF voltages are applied respectively in reset and storage periods, and that the OFF voltage applied to the gates of the thin film reset transistors is set to a value closer to the ON voltage applied to the gates of the thin film reset transistors than the OFF voltage applied to the gates of the thin film read transistors.

Independent Claim 9 recites, inter alia, thin film reset transistors connected respectively to corresponding storage capacitors and each having a gate to which ON and OFF voltages are applied respectively in reset and storage periods, and that any excessive electric charge is discharged by way of the thin film reset transistors in each storage period.

However, Applicant respectfully submits that none of the asserted citations, either alone or in combination (assuming arguendo that the citations may properly be combined) teaches or suggests at least the aforementioned features of independent Claims 1 and 9.

The primary citation, Huang, relates to a radiation imaging panel including conversion elements 4, capacitors 2, thin film read transistors 1, and thin film reset transistors 3. However, the gates of the thin film reset transistors 3 are connected in common to the gates of the thin film read transistors 1 of the next row. (See, e.g. Huang, Figure 3). As a result, the gate potential of the reset transistors cannot be controlled independently from the gate potential of the read transistors.

The secondary citation, Tsukamoto, et al., relates to an X-ray imaging apparatus and teaches a protective circuit 63c including a protective TFT 57, a voltage transforming capacitor 84 and a transformation charge source thin film transistor 85 (Tsukamoto, et al., Figure 20, Col. 20, lines 27-31) and is cited for its teaching of adjusting a gate voltage of a thin film transistor in order to sweep out stored charges when the voltage applied thereto exceeds a threshold value. Applicant submits that Tsukamoto, et al. adds nothing to the teachings of Huang that would remedy the aforementioned deficiency.

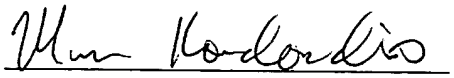
Regarding the rejection of Claims 4, 6, 7, 12, 14, and 15 under 35 U.S.C. §103, Jeuch, et al. relates to an ionizing radiation imaging device and is cited for its alleged teaching of forming conversion elements on a substrate different from an insulating substrate so as to allow the joining of a plurality of conversion element substrates and insulating substrates while Jeromin, et al. relates to a direct radiographic imaging panel with a shielding electrode and is cited for its alleged teaching of a shielding conductor arranged near a common electrode to prevent noise. (Office Action, pages 8, 9). Applicant submits that Jeuch, et al. and Jeromin, et al. add nothing to the teachings of Huang that would remedy the aforementioned deficiency.

In view of the foregoing, Applicant submits that the independent claims patentably define the present invention over the citations of record. Further, the dependent claims should also be allowable for the same reasons as the base claims from which they depend and further due to the additional features that they recite. Separate and individual consideration of each of the dependent claims is respectfully requested.

Applicant believes the present Amendment is responsive to each of the points raised by the Examiner in the Official Action and submits that the present application is in allowable form. Favorable consideration of the claims and passage to issue of the present application at the Examiner's earliest convenience earnestly are solicited.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE SPECIFICATION

The paragraph starting at page 2, lines 10-20 has been amended as follows.

--Referring to FIGS. 14A and 14B, as high energy electromagnetic waves 108 such as X rays enter the detector, an electric charge is generated in semiconductor substrates 106 typically made of Si, GaAs, CdTe or HgI_2 and transferred to readout circuits 116 of integrated circuit chips 110a and 110b by way of electrodes 114, bumps 120 and electrodes 119. Electrodes 134a through 134e and electrodes 130a through 130d as well as bumps 136 are provided to connect the semiconductor substrates 106 and the integrated circuit chips 110a and 110b.--

The paragraph starting at page 2, line 21 through page 3, line 6 -20 has been amended as follows.

--U.S. Patent No. 5,198,673 describes a direct type sensor equipped with protection diodes. FIG. 15 of the accompanying drawings is a schematic block diagram of the read/reset circuit of a direct type sensor 160 having protection diodes as disclosed in the above patent document. Referring to FIG. 15, there are shown scan switches 222a and 222b connected to scan wires 220a and 220b and output wires 230, the latter [letter] by turn being connected to sample-and-hold amplifiers (read circuits) 235 and reset circuits 237. The scan switches are also

connected to sensors 210, high voltage sources 212, storage capacitors 214 and overvoltage protection elements (protection diodes) 240.--

The paragraph starting at page 20, lines 8-12 has been amended as follows.

--Φ_{VR2} denotes the voltage applied to the gate of the transistor 8 for resetting the capacitance C_2 of the output line 5 to reference potential V_{R2} and Φ_{VR3} denotes the voltage applied to the gate of the transistor 11 [8] for resetting the capacitance C_{SH} to reference potential V_{R3}.--

VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE ABSTRACT

The Abstract has been amended as follows.

--An electromagnetic wave detector [or an area image sensor comprises a number of pixel units arranged into a matrix form and each pixel unit] includes a conversion element for converting incident electromagnetic waves or high energy radiations into an electric charge, a storage capacitor for storing the electric charge produced by the conversion element, a thin film read transistor connected to the storage capacitor, and a thin film reset transistor also connected to the storage capacitor. [The pixel units are operated in a storage-read-reset cycle on a row by row basis so that any electric charge left after the read period is expelled in the reset period.] To the gates of the read and reset thin film transistors [in each pixel] are applied ON and OFF voltages at predetermined timings and these voltages are set to values such that any excessive electric charge produced in the storage period is discharged by way of the thin film reset transistor, not by way of the thin film read transistor, in the same storage period.--

VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE CLAIMS

1. (Amended) An electromagnetic wave detector comprising:

conversion elements for converting incident electromagnetic waves or radiations into an electric charge;

storage capacitors for storing the electric charge produced by said conversion elements;

thin film read transistors connected respectively to the corresponding storage capacitors and each having a gate to which ON and OFF voltages are applied respectively in readout and storage periods; and

thin film reset transistors connected respectively to the corresponding storage capacitors and each having a gate to which ON and OFF voltages are applied respectively in reset and storage periods,

wherein the OFF voltage applied to the gates of said thin film reset transistors is [being] set to a value closer to the ON voltage applied to the gates of said [the] thin film reset transistors than the OFF voltage applied to the gates of said thin film read transistors [transistor].

4. (Amended) An electromagnetic wave detector according to claim 1, wherein said thin film read transistors and said thin film reset transistors are formed on an insulating substrate[;] and

wherein said conversion elements are formed on a substrate different from said insulating substrate and electrically connected to said thin film read transistors and said thin film reset transistors.

5. (Amended) An electromagnetic wave detector according to claim 1, wherein said conversion elements comprise [comprises] a semiconductor substrate having two opposite surfaces for converting electromagnetic waves into an electric charge, a common electrode arranged on the one surface of the semiconductor substrate and a plurality of electrodes formed on the other surface of the semiconductor substrate and separated from each other in correspondence to a plurality of two-dimensional pixels,[;]

wherein said thin film read transistors and said thin film reset transistors are formed on an insulating substrate such that unit cells each including one of the thin film read transistors and one of the thin film reset transistors are arranged on the insulating substrate in correspondence to the pixels,[;] and

wherein said semiconductor substrate and said insulating substrate form a layered structure and said plurality of electrodes and said unit cells are electrically connected between the substrates.

9. (Amended) An electromagnetic wave detector comprising:

conversion elements for converting incident electromagnetic waves or radiations into an electric charge;

storage capacitors for storing the electric charge produced by said conversion elements; and

thin film reset transistors connected respectively to the corresponding storage capacitors and each having a gate to which ON and OFF voltages are applied respectively in reset and storage periods,

wherein any excessive electric charge is [being] discharged by way of said [the] thin film reset transistors in each storage period.

12. (Amended) An electromagnetic wave detector according to claim 9, wherein said thin film read transistors and said thin film reset transistors are formed on an insulating substrate,[;] and

wherein said conversion elements are formed on a substrate different from said insulating substrate and electrically connected to said thin film read transistors and said thin film reset transistors.

13. (Amended) An electromagnetic wave detector according to claim 9, wherein said conversion elements comprises a semiconductor substrate having two opposite surfaces for converting electromagnetic waves into an electric charge, a common electrode arranged on the one surface of the semiconductor substrate and a plurality of electrodes formed on the other surface of the semiconductor substrate and separated from each other in correspondence to a plurality of two-dimensional pixels,[;]

wherein thin film read transistors and said thin film reset transistors are formed on an insulating substrate such that unit cells each including one of the thin film read transistors and one of the thin film reset transistors are arranged on the insulating substrate in correspondence to the pixels,[;] and

wherein said semiconductor substrate and said insulating substrate form a layered structure and said plurality of electrodes and said unit cells are electrically connected between the substrates.

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